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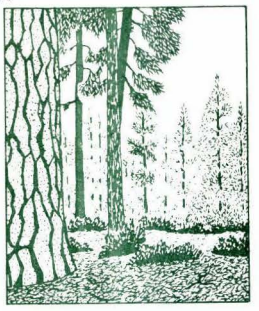

FOREST RESEARCH NOTES

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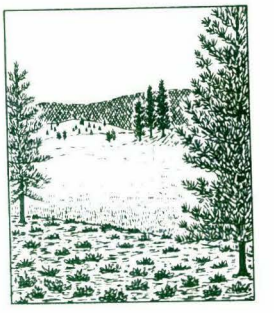

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HARDWOOD SPROUT MEASUREMENTS IN NORTHWESTERN CALIFORNIA

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Some California hardwood trees regenerate quickly after their aerial parts are destroyed by fire or logging. Quick recovery by sprouting may be desirable to prevent soil erosion or for other reasons. More often, however, hardwood sprouts are pernicious. They capture ground area which otherwise could be used to grow conifers; they compete with conifers and may suppress them; and their leaves often smother young conifer seedlings and transplants. If new sprouts develop vigorously, special treatments may be necessary to obtain adequate stocking of desired conifers, whether by artificial or natural means.

Some foresters have been concerned about areas of forest land in northwestern California which are producing only presently non-commercial hardwoods. Here hardwoods often dominate the vegetational cover after logging or fire, but their aggressiveness has not been studied. Foresters, therefore, may be interested in data about some of the more important sprouting hardwoods which prove that northwestern California, like some other parts of the United States, has a hardwood problem.

The Study

Sprouts were measured at two places--the Three Creeks Burn, which lies about 5 miles west of Willow Creek, Humboldt County; and the Slate Creek cut-over unit, which is 7 miles north and slightly east of Weaverville, Trinity County. Madrone (Arbutus menziesii Pursh), Oregon white oak (Quercus garryana Dougl.), locally called Brewer oak[1/], tanoak (Lithocarpus densiflorus (Hook. and Arn.) Rehd.), and bigleaf maple

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1/ McMinn, Howard E. An illustrated manual of California shrubs. Berkeley and Los Angeles, California. 663 pp. 1951.

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(Acer macrophyllum Pursh) sprouts were measured at Three Creeks. Dogwood (Cornus nuttalii Audubon) sprouts were examined at Slate Creek.

The Three Creeks Fire began on August 18, 1951, and was not controlled until August 23. Starting in heavy logging slash, it burned intensely, clearing the ground of flammable material and killing almost all conifers and hardwoods alike. Consequently, the aerial parts of the parent trees producing the sprout clumps were dead.

The Slate Creek Unit was clearcut by alternate blocks in 1950 and 1951. Logging completely destroyed the parent dogwood trees. A large proportion of the clumps sprouted from former skid roads.

Sprouts were measured first on November 10, 1952, when data for madrone clumps were recorded. The madrone clumps, plus 50 Oregon white oak, 50 tanoak, and 10 bigleaf maple sprout clumps, were also measured on October 30, 1953, and September 16, 1954. The dogwood sprouts were measured on November 8, 1953, and October 13, 1954.

Sprout Development by Species

Sprout development was vigorous although differing between species. Growth of bigleaf maple sprouts has been most spectacular. They are the tallest 2/. They also have more sprouts and cover more ground space per clump than other species. At the end of the third growing season the average clump of bigleaf maple sprouts was 13 feet tall, 15 feet in diameter, and included 37 sprouts (table 1). Sprouting of bigleaf maple is not as important to foresters, however, as that of other species because the maple is not widely distributed. It grows only on stream banks or other situations where soil moisture is abundant.

Madrone sprouts were the second most vigorous. At the end of the third year these clumps averaged 10 feet in height, 8 feet in diameter, and 13 in number of sprouts. Although not as vigorous as bigleaf maple, madrone sprouts are more important in forestry because they are distributed more widely than other species except tanoak.

In order of decreasing vigor, madrone sprouts were followed by Oregon white oak, tanoak, and dogwood. But even the development of dogwood sprouts was impressive. In 3 years the average clump had 14

2/ Comparisons in this report are made in the statistically significant sense.

Table 1.--Hardwood sprout development after burning or logging, northwestern California, 1952-54

Time since burning or logging, and species	Sprout clumps measured	Height of tallest sprout in clump		Crown diameter of sprout clump		Sprouts per clump	
		Average	Range	Average	Range	Average	Range
	No.	Ft.	Ft.	Ft.	Ft.	No.	No.
First year							
Madrone	50	4.7	1.6- 7.6	4.5	0.8- 8.9	17	1- 47
Second year							
Bigleaf maple	10	9.8	6.8-13.1	11.5	6.8-15.5	78	14-143
Madrone	50	7.7	3.2-11.5	6.8	2.0-13.7	16	1- 47
Oregon white oak	50	6.6	4.4-11.2	6.8	2.9-12.3	18	1- 57
Tanoak	50	5.2	2.2- 8.3	6.2	2.9-11.5	27	7- 79
Dogwood	50	4.2	1.2- 7.4	4.5	0.8- 9.1	19	1- 98
Third year							
Bigleaf maple	10	12.8	7.5-17.1	14.7	10.4-21.5	37	8- 67
Madrone	1/ 48	10.1	4.9-14.8	7.6	2.8-16.5	13	1- 32
Oregon white oak	1/ 49	9.2	6.1-12.8	8.2	3.5-12.3	10	1- 25
Tanoak	50	6.8	2.2-10.3	7.0	3.4-12.1	12	4- 25
Dogwood	50	5.9	2.4- 9.9	5.4	1.3- 9.4	14	1- 84

1/ Number of sprout clumps measured reduced by salvage logging operation.

sprouts, the tallest being 6 feet high, and was 5 feet in diameter. Comparison of dogwood sprouts with the others studied is not strictly valid because the dogwood clumps are growing about 50 miles further east in a different environment.

One ecological pressure affecting dogwood sprouts, but not others, was browsing by deer. On the Slate Creek Unit browsing damage to conifers has been almost non-existent, but 62 percent of the dogwood sprout clumps have been browsed to some degree. Of these, 10 percent were browsed heavily.

The number of living sprouts was reduced drastically between the second and third growing seasons. Weak sprouts died and growth was concentrated on fewer stems. Reductions were: bigleaf maple--from 78 sprouts per clump in the second year to 37 sprouts in the third year; madrone--16 to 13; Oregon white oak--27 to 10; tanoak--27 to 12; and dogwood 19 to 14.

When species were ranked by heights of the tallest sprouts, or by clump diameters, differences between species were statistically significant. For number of sprouts per clump, bigleaf maple had significantly more than other species, but the only other significant difference was between madrone (ranked second) and Oregon white oak (ranked fifth and last).

Diameter of Parent Tree Affects Sprout Development

Root systems increase in size as trees grow larger. Therefore, the root systems of larger parent trees should produce more vigorous sprout clumps. This hypothesis was checked by separate regression analyses relating diameter of the parent tree to height of the tallest sprout, to diameter of the sprout clumps, and to number of sprouts per clump. Measurements taken at the end of the third growing season were used.

Analyses showed that the diameter of the parent tree significantly affected the height and diameter growth of sprout clumps, and the number of sprouts per clump (figures 1, 2, and 3). For example, the tallest madrone sprout in a clump was 0.59 foot taller for each additional inch of the parent tree's diameter. Clump diameter increased 0.75 foot, and number of sprouts increased 1.77 for each additional inch of diameter. All regression coefficients were statistically significant except for bigleaf maple where sprout height and clump diameter were less dependent upon the parent tree's diameter.

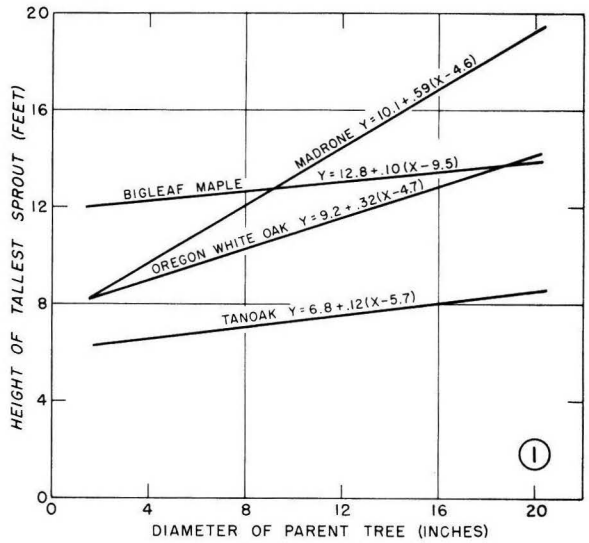

Figure 1.--Relation of height of tallest sprout in clump to diameter of parent tree, end of the third growing season.

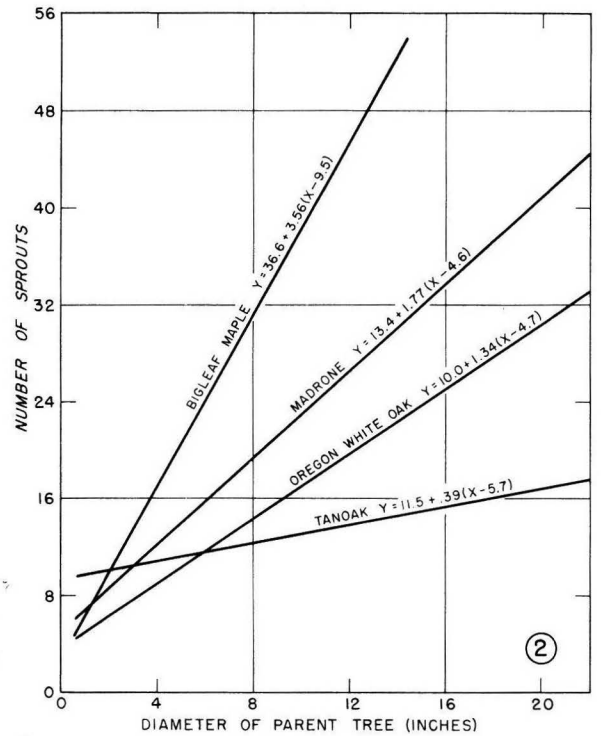

Figure 2.--Relation of number of sprouts per clump to diameter of parent tree, end of the third growing season.

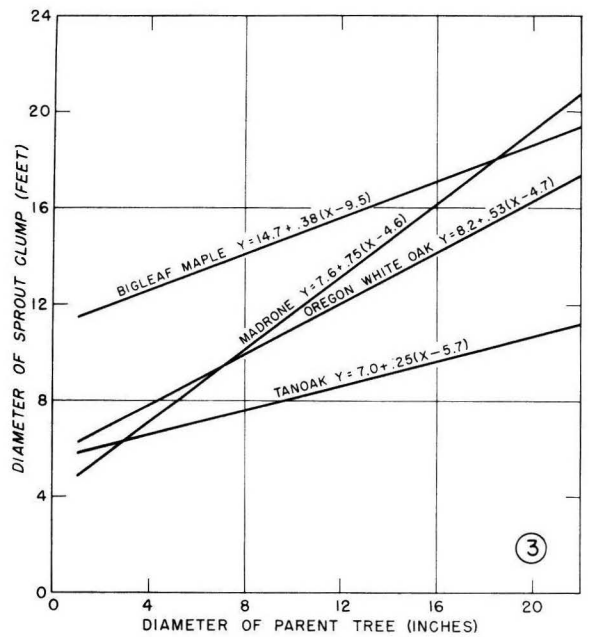

Figure 3.--Relation of diameter of the sprout clump to diameter of parent tree, end of the third growing season.

Conclusions

Conclusions from measurements of sprouts of hardwood trees in northwestern California are:

1. After destruction of their aerial portions by fire or logging operations, several kinds of hardwoods produced vigorous sprouts.

2. Sprout height growth differed by species; in descending order, bigleaf maple, madrone, Oregon white oak, tanoak, and dogwood.

3. The parent trees of larger diameter produced more sprouts, taller sprouts, and wider clumps.

These facts can be useful to the forester desiring to regenerate a burned or logged area. After spacing and species of potential sprout producers are determined in the field, information such as that presented here can be applied to calculate the ground area which will remain available for conifer reproduction. If hardwoods are too numerous, hardwood poisoning will be necessary and appropriate action can be planned well in advance. When trees or seed are planted, spots near living hardwood stumps or root crowns should be avoided. Small trees cannot compete with vigorous sprouts. Therefore, planting must be limited to places which will remain open until conifers dominate other vegetation.